We Claim:

1. A system for separating a multi phase mixture comprising:

a centrifuge configured to separate the mixture into a first liquid phase component, a second liquid phase component and a solid phase component; and

a control system programmed with a set of fuzzy logic rules;

the control system configured to sense feed variables of the mixture into the centrifuge and to adjust a feed temperature and a feed rate of the mixture based on the variables and the set of fuzzy logic rules.

2. The system of claim 1 wherein the control system further comprises a filter configured to differentiate signals representative of the feed variables from noise.

3. The system of claim 1 wherein the control system is configured to measure feedback parameters and is configured to adjust the feed temperature and the feed rate based on the feedback parameters.

4. The system of claim 1 further comprising a heater configured to heat the mixture to the feed temperature and a pump in signal communication with the controller configured to pump the mixture into the centrifuge at the feed rate.

5. The system of claim 1 wherein the mixture comprises an oil emulsion, the first liquid phase component comprises oil and the second liquid phase component comprises water.

6. A system for separating a multi phase mixture comprising:

a centrifuge configured to separate the mixture into a first liquid phase component, a second liquid phase component and a solid phase component; and

a feed forward control system comprising a plurality of sensors, a fuzzy soft sensor in signal communication with the sensors programmed with a set of fuzzy logic rules, and a controller in signal communication with the fuzzy soft sensor,

the feed forward control system configured to sense feed variables of the mixture into the centrifuge and to adjust a feed temperature and a feed rate of the mixture based on the feed variables and the set of fuzzy logic rules.

7. The system of claim 6 further comprising a feedback control system configured to measure feedback variables in the first liquid phase component or the second liquid phase component and to adjust the feed temperature and the feed rate based on the feedback variables and the set of fuzzy logic rules.

8. The system of claim 7 wherein the feedback control system includes a BS&W sensor configured to measure a basic solids and water content of the first liquid phase component and to adjust the feed temperature and the feed rate based on the basic solids and water content and the set of fuzzy logic rules.

9. The system of claim 7 wherein the feedback control system comprises a feedback controller including a conflict resolution portion configured to coordinate the operation of the controller and the feedback controller.

10. The system of claim 6 wherein the feed variables include a feed temperature and a feed rate.

11. The system of claim 6 wherein the feed variables include a feed temperature, a feed rate, a percent change of water and a percent change of solid expressed as a single feed magnitude change variable.

12. The system of claim 6 further comprising a filter in signal communication with the fuzzy soft sensor configured to differentiate signals representative of the feed variables from noise.

13. The system of claim 6 further comprising a heater in signal communication with the controller configured to heat the mixture to the feed temperature and a pump in signal communication with the controller configured to pump the mixture into the centrifuge at the feed rate.

14. The system of claim 6 wherein the mixture comprises an oil emulsion, the first liquid phase component comprises oil and the second liquid phase component comprises water.

15. A system for separating a multi phase mixture comprising:

a centrifuge configured to separate the mixture into a first liquid phase component, a second liquid phase component and a solid phase component;

a heater configured to heat the mixture to a temperature set point (T2);

a pump configured to pump the mixture into the centrifuge;

a fuzzy soft sensor in signal communication with a first sensor configured to sense a feed temperature (T1) of the mixture and a second sensor configured to sense a basic solids and water content of the mixture;

a set of fuzzy logic rules programmed into the fuzzy soft sensor and configured to express input from the first

sensor and the second sensor into at least one feed change variable; and

a controller in signal communication with the fuzzy soft sensor configured to adjust the temperature set point (T2) for the mixture, and to adjust a speed of the pump to achieve a selected feed rate for the mixture.

16. The system of claim 15 further comprising a third sensor configured to measure a basic solids and water content of the first liquid phase component, and a feedback controller in signal communication with the third sensor configured to adjust the temperature set point (T2) and the speed of the pump based on the rules and input from the third sensor.

17. The system of claim 15 wherein the mixture comprises an oil emulsion, the first liquid phase component comprises oil and the second liquid phase component comprises water.

18. The system of claim 15 further comprising a filter in signal communication with the fuzzy soft sensor configured to differentiate signals from the first sensor and the second sensor from noise.

19. The system of claim 15 wherein the centrifuge comprises a rotatable bowl for separating the first liquid phase component and the second liquid phase component and an auger for separating the solid phase component.

20. The system of claim 15 wherein the centrifuge includes a tank configured to collect the first liquid phase component and a vapor recovery unit configured to collect and condense vapor from the catch tank.

21. The system of claim 20 wherein the vapor recovery unit comprises a fan configured to move the vapor and a plurality of baffles configured to condense the vapor.

22. The system of claim 15 wherein the rules are in the form of if "feed water composition change "is ... and "feed solid composition change" is ... and "cold temperature feed change" is ... then "feed pump speed change" is ... and "feed heater setpoint change" is....

23. A process for separating a multi phase mixture comprising:

providing a centrifuge configured to separate the mixture into a first liquid phase component, a second liquid phase component and a solid phase component; and

providing a fuzzy soft sensor programmed with a set of fuzzy logic rules;

sensing feed variables of the mixture; and

adjusting a feed temperature and a feed rate of the mixture into the centrifuge based on the feed variables and the set of fuzzy logic rules.

24. The process of claim 23 wherein the variables include the feed temperature, a percent change of water and a percent change of solid of the mixture.

25. The process of claim 23 wherein the feed variables include a feed temperature, a feed rate, a percent change of water and a percent change of solid expressed as a single feed magnitude change variable.

26. The process of claim 23 further comprising providing a filter in signal communication with the fuzzy soft sensor and differentiating noise from signals representative of the variable using the filter.

27. The process of claim 23 further comprising sensing at least one feedback variable in the first liquid phase component or in the second liquid phase component and adjusting the feed temperature and the feed rate using the feedback variable.

28. The process of claim 23 wherein the mixture comprises an oil emulsion, the first liquid phase component comprises oil and the second liquid phase component comprises water.

29. A process for separating a multi phase mixture comprising:

providing a centrifuge configured to separate the mixture into a first liquid phase component, a second liquid phase component and a solid phase component;

providing a feed pump configured to pump the mixture into the centrifuge at a feed rate;

providing a heater configured to heat the mixture to a temperature set point;

providing a fuzzy soft sensor programmed with a set of fuzzy logic rules that relate a feed water composition change of the mixture, a feed solid composition change of the mixture, and a cold feed temperature change of the mixture to a feed pump speed change for the feed pump, and to a heater setpoint change for the heater;

sensing the basic solids and water content of the mixture and the cold feed temperature;

relating the basic solids and water content to the feed water composition change and to the feed solid composition change; and

adjusting the feed rate and the temperature set point using the rules, the sensing step and the relating step.

30. The process of claim 29 wherein the mixture comprises an oil emulsion, the first liquid phase component comprises oil and the second liquid phase component comprises water.

31. The process of claim 29 further comprising sensing a basic solids and water content of the first liquid phase component to provide feedback data and adjusting the feed rate and the temperature set point using the feedback data.

32. The process of claim 29 further comprising sensing an oil content of the second liquid phase component to provide additional feedback date and adjusting the feed rate and the temperature set point using the additional feedback data.

33. The process of claim 29 further comprising collecting the first liquid phase component in a tank, collecting the vapor from the tank, and condensing the vapor.

34. The process of claim 33 further comprising providing a vapor recovery unit comprising a fan configured to move the vapor and a plurality of baffles configured to condense the vapor.